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Donald G. Stitts

University of Connecticut - Storrs

Eisenhower J. Douglas

University of Connecticut - Storrs

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The Effect of Size and Type of Operation on the Cost of Producing Eggs in Connecticut



By Donald G. Stitts and Eisenhower J. Douglas

Department of Agricultural Economics and Rural Sociology

STORRS AGRICULTURE EXPERIMENT STATION
COLLEGE OF AGRICULTURE AND NATURAL RESOURCES
THE UNIVERSITY OF CONNECTICUT, STORRS, CONNECTICUT 06268

I INTRODUCTION

A. Problem

In Connecticut the number of birds per farm has been increasing. According to the U.S. Census of Agriculture, in 1964 approximately 1500 egg producing farms housed 4 million birds of laying age; in 1974, 551 egg producers housed 4½ million birds of laying age.¹ The number of birds had increased 13% but the number of farms had decreased 63%. This implies an average increase in farm size of 206%. U.S. Census of Agriculture reports similar changes have been occurring in other states.²

This increase in number of birds per farm has been associated with changes in the capital labor ratio. According to the results of a poultry management study conducted in California, in 1958 an average of 0.8 labor hours per year was needed per hen, whereas in 1964, that rate had changed to 0.3 labor hours per hen.³ This illustrates substitutions of capital for labor.

However, while increasing capital intensity means substitutions of capital for labor, it also signifies higher investment costs per bird. Thus, a farmer's decision to invest will depend in part upon the prevailing level of interest rates. High interest rates will

discourage investment. Similarly, increased capital intensity signifies a heavier reliance upon electricity and/or fossil fuel use. The cost of energy will therefore significantly influence the farmer's investment decision. In fact, in this era of high interest rates and of rising energy costs, a complete evaluation of the economic implications of continued capital intensity is in order.

B. Objectives

This study presents costs of producing white eggs in Connecticut under alternative equipment/building combinations using presently available technology. The objectives of the study were the following:

1. To develop production costs for selected plant sizes in both floor and cage management systems.
2. To compare production costs for floor and cage management systems in flocks of similar size.
3. To compare production costs for the selected plants when the cost of energy, labor, building, equipment and interest change.

II METHODOLOGY

A. Procedure

Poultry housing information and the extent of automation in use on Connecticut farms was obtained by data provided by the Connecticut Department of Agriculture. Costs used are considered representative for the industry in 1977.

In order to ascertain "standards of performance" especially for energy and labor usage, poultry extension agents assisted in the designing and the distribution of a questionnaire to estimate the costs of production. Twenty-six poultry farms were selected, the operators were interviewed and the data obtained were used in this study.

The costs of feed, started pullets, electricity, supplies, and bird insurance were obtained by consulting the appropriate farm input suppliers.

B. Specification of Model Plants

Twelve basic model plants were required to represent six plant sizes for the cage-type system and six plant sizes for the floor-type system. (Table 1) The plant sizes for the floor-type system comprise 9,728, 15,360, 20,000, 25,000, 30,208, and 32,000 birds. In cage models, plant size was determined according to cage row length. Cage row lengths considered varied from 152' to 480'.

Considering the variations in plant size, type of equipment system, and building type, twenty-two model plants were needed to analyze the floor-type system. Table 2 gives some indication as to the degree of automation utilized in model plants.

Based upon the data obtained from the survey and the appropriate farm input suppliers, representa-

1. 1974 Census of Agriculture, U.S. Department of Commerce, Bureau of Census, Vol. 1, Part 7.

2. Ibid.

3. Card, L.E. and L.C. Nesheim, *Poultry Production*, Philadelphia, Lee and Feiger, 1972, p. 350.

Table 10. Effect on Production Costs of Changing Interest Rate in the Floor-Type System and in the Double-Deck Cage System, Deep-Pit House

Type of Plant and Item	Floor		Cage		Cost Advantage/Cage		Cost Reduction
	Interest rate at 8% of average value	Interest rate at 12% of average value	Interest rate at 8% of average value	Interest rate at 12% of average value	Interest rate at 8% of average value	Interest rate at 12% of average value	
9728 layers-floor							
9728 layers-cage							
Total Cost	\$112,551.87	\$114,441.28	\$104,887.33	\$106,782.84	1.15¢	1.10¢	.05¢
Cost/dozen eggs	56.21¢	57.15¢	55.06¢	56.05¢			
15360 layers-floor							
15360 layers-cage							
Total Cost	\$173,737.29	\$176,406.39	\$159,363.32	\$161,910.49	1.97¢	1.96¢	.01¢
Cost/dozen eggs	54.95¢	55.79¢	52.98¢	53.83¢			
20000 layers-floor							
20000 layers-cage							
Total Cost	\$222,625.44	\$225,795.77	\$204,634.66	\$207,733.97	1.83¢	1.80¢	.03¢
Cost/dozen eggs	54.08¢	54.84¢	52.25¢	53.04¢			
25000 layers-floor							
25000 layers-cage							
Total Cost	\$276,787.62	\$280,623.36	\$252,828.32	\$256,442.49	2.15¢	2.14¢	.01¢
Cost/dozen eggs	53.79¢	54.52¢	51.64¢	52.38¢			
30208 layers-floor							
30208 layers-cage							
Total Cost	\$332,037.75	\$336,462.01	\$304,944.52	\$309,236.28	1.86¢	1.84¢	.02¢
Cost/dozen eggs	53.40¢	54.11¢	51.54¢	52.27¢			

Table 11. Effect on Production Costs of Increasing Building Cost by Ten Percent in the Floor-Type System and in the Double-Deck System, Deep-Pit House

Type of Plant and Item	Floor		Cage		Cost Advantage/Cage		Cost Advantage
	With Building Cost Before the Change	With Building Cost After the Change	With Building Cost Before the Change	With Building Cost After the Change	With Building Cost Before the Change	With Building Cost After the Change	
9728 layers-floor							
9728 layers-cage							
Total Cost	\$112,551.87	\$113,780.73	\$104,887.33	\$105,587.53	1.15¢	1.40¢	.25¢
Cost/dozen eggs	56.21¢	56.82¢	55.06¢	55.42¢			
15360 layers-floor							
15360 layers-cage							
Total Cost	\$173,737.29	\$175,517.47	\$159,363.32	\$160,396.61	1.97¢	2.19¢	.22¢
Cost/dozen eggs	54.95¢	55.51¢	52.98¢	53.32¢			
20000 layers-floor							
20000 layers-cage							
Total Cost	\$222,625.44	\$225,117.86	\$204,634.66	\$205,739.18	1.83¢	2.15¢	.32¢
Cost/dozen eggs	54.08¢	54.68¢	52.25¢	52.53¢			
25000 layers-floor							
25000 layers-cage							
Total Cost	\$276,787.62	\$279,843.98	\$252,828.32	\$255,506.19	2.15¢	2.20¢	.05¢
Cost/dozen eggs	53.79¢	54.83¢	51.64¢	52.18¢			
30208 layers-floor							
30208 layers-cage							
Total Cost	\$332,037.75	\$335,056.20	\$304,944.52	\$306,677.27	1.86¢	2.04¢	.18¢
Cost/dozen eggs	53.40¢	53.88¢	51.54¢	51.84¢			

Table 12. Effect on Production Costs of Increasing Equipment Cost by Ten Percent in the Floor-Type System and in the Double-Deck System, Deep-Pit House

Type of Plant and Item	Floor		Cage		Cost Advantage/Cage		Cost Reduction Advantage due to equipment cost increase
	With equip. cost before the change	With equip. cost after the change	With equip. cost before the change	With equip. cost after the change	With equip. cost before the change	With equip. cost after the change	
9728 layers-floor							
9728 layers-cage							
Total Cost	\$112,551.87	\$113,320.68	\$104,887.33	\$106,585.97	1.15¢	.64¢	.51¢
Cost/dozen eggs	56.21¢	56.59¢	55.06¢	55.95¢			
15360 layers-floor							
15360 layers-cage							
Total Cost	\$173,737.29	\$174,746.30	\$159,363.32	\$161,483.97	1.97¢	1.59¢	.38¢
Cost/dozen eggs	54.95¢	55.27¢	52.98¢	53.68¢			
20000 layers-floor							
20000 layers-cage							
Total Cost	\$222,625.44	\$223,809.18	\$204,634.66	\$207,173.05	1.83¢	1.47¢	.36¢
Cost/dozen eggs	54.08¢	54.36¢	52.25¢	52.89¢			
25000 layers-floor							
25000 layers-cage							
Total Cost	\$276,787.62	\$278,178.19	\$252,828.32	\$255,720.28	2.15¢	1.83¢	.32¢
Cost/dozen eggs	53.79¢	54.06¢	51.64¢	52.23¢			
30208 layers-floor							
30208 layers-cage							
Total Cost	\$332,037.75	\$333,592.69	\$304,944.52	\$308,532.00	1.86¢	1.50¢	.36¢
Cost/dozen eggs	53.40¢	53.65¢	51.54¢	52.15¢			

Table 13. Effect on Production Costs of Increasing Labor Cost by Ten Percent in the Floor-Type System and in the Double-Deck Cage System, Deep-Pit House

Type of Plant and Item	Floor		Cage		Cost Advantage/Cage		Cost Advantage Increase due to labor cost increase
	With labor cost before the change	With labor cost after the change	With labor cost before the change	With labor cost after the change	With labor cost before the change	With labor cost after the change	
9728 layers-floor							
9728 layers-cage							
Total Cost	\$112,551.87	\$113,940.97	\$104,887.33	\$105,270.37	1.15¢	1.64¢	.49¢
Cost/dozen eggs	56.21¢	56.90¢	55.06¢	55.26¢			
15360 layers-floor							
15360 layers-cage							
Total Cost	\$173,737.29	\$175,904.42	\$159,363.32	\$159,941.08	1.97¢	2.47¢	.50¢
Cost/dozen eggs	54.95¢	55.64¢	52.98¢	53.17¢			
20000 layers-floor							
20000 layers-cage							
Total Cost	\$222,625.44	\$225,446.82	\$204,634.66	\$205,389.47	1.83¢	2.32¢	.49¢
Cost/dozen eggs	54.08¢	54.76¢	52.25¢	52.44¢			
25000 layers-floor							
25000 layers-cage							
Total Cost	\$276,787.62	\$280,307.37	\$252,828.32	\$253,781.53	2.15¢	2.64¢	.49¢
Cost/dozen eggs	53.79¢	54.47¢	51.64¢	51.83¢			
30208 layers-floor							
30208 layers-cage							
Total Cost	\$332,037.75	\$336,233.56	\$304,944.52	\$306,088.76	1.86¢	2.33¢	.47¢
Cost/dozen eggs	53.40¢	54.07¢	51.54¢	51.74¢			

Table 14. Effect on Production Costs of Increasing Cost of Utilities by Ten Percent in the Floor-Type System and in the Double-Deck Cage System, Deep-Pit House

Type of Plant and Item	Floor		Cage		Cost Advantage/Cage		Cost Advantage due to the increase in cost of utilities
	With Utilities Cost Before the Change	With Utilities Cost After the Change	With Utilities Cost Before the Change	With Utilities Cost After the Change	With Utilities Cost Before the Change	With Utilities Cost After the Change	
9728 layers-floor							
9728 layers-cage							
Total Cost	\$112,551.87	\$112,763.23	\$104,887.33	\$105,048.84	1.15¢	1.17¢	.02¢
Cost/dozen eggs	56.21¢	56.31¢	55.06¢	55.14¢			
15360 layers-floor							
15360 layers-cage							
Total Cost	\$173,737.29	\$174,050.21	\$159,363.32	\$159,600.02	1.97¢	2.00¢	.03¢
Cost/dozen eggs	54.95¢	55.06¢	52.98¢	53.05¢			
20000 layers-floor							
20000 layers-cage							
Total Cost	\$222,625.44	\$223,022.24	\$204,634.66	\$204,930.74	1.83¢	1.85¢	.02¢
Cost/dozen eggs	54.08¢	54.17¢	52.25¢	52.32¢			
25000 layers-floor							
25000 layers-cage							
Total Cost	\$276,787.62	\$277,276.46	\$252,828.32	\$253,189.75	2.15¢	2.17¢	.02¢
Cost/dozen eggs	53.79¢	53.88¢	51.64¢	51.71¢			
30208 layers-floor							
30208 layers-cage							
Total Cost	\$332,037.75	\$332,620.59	\$304,944.52	\$305,375.41	1.86¢	1.87¢	.01¢
Cost/dozen eggs	53.40¢	53.49¢	51.54¢	51.62¢			

Table 1. Specification of Model Plants

Cage-Type Management System							
Type of Equip. System	Type of Building	152'	240'	Cage Row Length & Number of Layers		472'	480'*
				312'	392'		
Double deck	Shallow-pit	9,728	15,360	20,000	25,000	30,208	38,400
Double-deck	Deep-pit	9,728	15,360	20,000	25,000	30,208	38,400
Triple-deck	Shallow-pit	18,240	28,800	37,440	-----	56,640	72,000
Triple-deck	Deep-pit	18,240	28,800	37,440	-----	56,640	72,000

Floor-Type Management System		
Type of Equip. System	Type of Building	Number of Birds
Automated	Single-story	9,728
Automated	Single-story	15,360
Automated	Two-story	20,000
Automated	Two-story	25,000
Automated	Two-story	30,208
Automated	Two-story	32,000

*This building has five cage rows. All other buildings in the cage-type management system have four cage rows.

Table 2. Different Types of Equipment Systems Considered in the Model Plants*

Type of Equipment System	Operation				
	Feeding	Watering	Collecting Eggs	Removing Manure	Ventilation
Floor-type management system	1	1	2	2	1
Cage-type management system	1	1	1	1	1

*A "1" in the table denotes that the operation was performed by automatic equipment.
A "2" in the table denotes that the operation was performed mechanically or by hand.

tive farm units were developed to represent present day market egg production units.

All units were assumed to be:

1. Single-plant operations
2. Operated as specialized egg-producing businesses

In addition, it was assumed that:

a. Housing

Birds are housed in one-story and two-story, clear-span, windowless houses designed to have an efficient, controlled environment. In cage models, shallow-pit and deep-pit houses were used.

b. Land

The price of land was omitted because it was assumed that the price of land would be the same for all systems.

c. Management System

Cages — Consideration was given to double-deck and triple-deck systems as they are the typical cage arrangement in Connecticut.

Floor — The typical unslatted floor system was used.

d. Manure Disposal

In cage models, two types of manure disposal systems were used: the scraper cross-conveyor and the deep-pit. The scraper cross-conveyor employs mechanical equipment to clean out the coop. The deep-pit allows droppings to accumulate in the pit and dry. The droppings are removed between flocks. In floor models, the litter type system was used.

e. Bird Density

Cages — Based upon the recommendation of equipment representatives and the sizes most commonly found in Connecticut, two cage sizes were selected; in the double-deck systems, 12" x 18" cages holding 4 birds per cage were used. In the triple-deck systems, 12" x 20" cages with 5 birds per cage were used.

Floor — In the floor-type systems,

⁴ Mortality losses are not replaced during the production period.

1 bird per 1.35 sq. ft. of floor space was used.

f. Type of Bird

For all models a standard commercial white egg producing breed was used.

g. Egg Production Per Hen

It was assumed that birds were housed at 22 weeks of age and kept in production for 51 weeks. Rate of lay per hen housed in cage-type systems was 235 eggs per bird per year. Rate of lay in floor-type systems was 247 eggs per bird per year.

h. Feed Consumption

A commercial laying ration containing 18% protein was used for cage birds; a ration containing 17% protein was used for floor birds. Feed consumption per bird in both systems (cage and floor) was assumed to be 82.1 lbs. per bird in 51 weeks.

i. Mortality

Bird mortality was assumed to be 12% per year in both systems.⁴

j. Lighting

Twenty-five watt bulbs spaced 8 feet apart in rows was used. Lights are provided for 16 hours each day.

k. Disposal Pit for Poultry

Dead birds are assumed disposed of in a pit instead of being incinerated. Disposal pit construction costs range from \$1500 to \$3500 according to the size of the operation.

C. Capital Investments

The required capital investment for buildings and equipment are presented in Tables 3 to 7.

Building:

The floor space within each plant was divided into three basic areas according to purposes served. These are: (1) production area where the laying birds are confined; (2) service area - office, employee lunch room and storage area for egg cases; (3) cooler-refrigerated egg room with a 3-day egg holding capacity. Building costs include excavation for building, concrete

Table 3. Summary of Investment Outlays for Plant Buildings and Equipment: Tri-Deck Cage System, Shallow-Pit House

<i>Costs</i>	18,240	28,800	37,440	56,640	72,000
<i>(Number of birds)</i>					
Building costs	\$ 38,480.00	\$ 56,784.00	\$ 70,992.00	\$ 96,820.00	\$115,920.00
Equipment costs	<u>95,412.52</u>	<u>123,229.14</u>	<u>144,952.94</u>	<u>196,601.77</u>	<u>237,010.64</u>
Material handling	82,080.32	107,284.00	126,687.12	176,289.32	213,353.27
Electrical	7,126.20	7,888.04	8,582.47	10,628.95	13,171.37
Generator	6,206.00	8,057.10	9,683.35	9,683.50	10,486.00
Total cost for build- ings and equipment	\$133,892.52	\$180,013.14	\$215,944.94	\$293,421.77	\$352,930.64
Investment costs/bird (buildings and equipment)	\$ 7.34	\$ 6.25	\$ 5.76	\$ 5.18	\$ 4.90

Table 4. Summary of Investment Outlays for Plant Buildings and Equipment: Tri-Deck Cage System, Deep-Pit House

<i>Costs</i>	18,240	28,800	37,440	56,640	72,000
<i>(Number of birds)</i>					
Building costs	\$ 39,590.00	\$ 58,422.00	\$ 73,080.00	\$ 99,910.00	\$119,700.00
Equipment costs	<u>86,630.30</u>	<u>114,141.88</u>	<u>135,617.26</u>	<u>186,710.18</u>	<u>224,523.63</u>
Material handling	74,494.36	99,393.00	118,547.55	167,593.99	202,629.08
Electrical	5,929.94	6,691.78	7,386.21	9,432.69	11,408.55
Generator	6,206.00	8,057.10	9,683.50	9,683.50	10,486.00
Total cost for build- ings and equipment	\$126,220.30	\$172,563.88	\$208,697.26	\$286,620.18	\$344,223.63
Investment cost/bird (buildings and equipment)	\$ 6.92	\$ 6.00	\$ 5.57	\$ 5.06	\$ 4.78

Table 5. Summary of Investment Outlays for Plant Buildings and Equipment: Double-Deck Cage System, Shallow-Pit House

<i>Costs</i>	9,728	15,360	20,000	25,000	30,208	38,400
	<i>(Number of birds)</i>					
Building costs	\$ 38,480.00	\$ 56,784.00	\$ 70,380.00	\$ 84,150.00	\$ 94,940.00	\$ 113,270.40
Equipment costs	<u>63,967.51</u>	<u>78,023.62</u>	<u>91,852.13</u>	<u>103,404.41</u>	<u>126,509.43</u>	<u>154,393.58</u>
Material handling	52,276.69	65,951.88	77,548.37	88,814.96	109,912.66	135,985.28
Electrical	5,484.82	5,865.74	6,246.66	6,532.35	6,913.27	8,724.80
Generator	6,206.00	6,206.00	8,057.10	8,057.10	\$9,683.50	9,683.50
Total cost for build- ings and equipment	\$102,447.51	\$134,807.62	\$162,232.13	\$187,554.41	\$221,449.43	\$267,663.98
Investment costs/bird (buildings and equipment)	\$ 10.53	\$ 8.78	\$ 8.12	\$ 7.50	\$ 7.33	\$ 6.97

Table 6. Summary of Investment Outlays for Plant Buildings and Equipment: Double-Deck Cage System, Deep-Pit House

<i>Costs</i>	9,728	15,360	20,000	25,000	30,208	38,400
	<i>(Number of birds)</i>					
Building costs	\$ 39,590.00	\$ 58,422.00	\$ 72,450.00	\$ 86,700.00	\$ 97,970.00	\$ 116,964.00
Equipment costs	<u>55,185.29</u>	<u>68,936.33</u>	<u>82,515.23</u>	<u>94,008.57</u>	<u>116,617.84</u>	<u>140,787.35</u>
Material handling	44,690.73	58,060.85	69,407.73	80,615.38	101,217.33	124,141.88
Electrical	4,288.56	4,669.48	5,050.40	5,336.09	5,717.01	6,961.97
Generator	6,206.00	6,206.00	8,057.10	8,057.10	9,683.50	9,683.50
Total cost for build- ings and equipment	\$ 94,775.29	\$127,358.33	\$154,965.23	\$180,708.57	\$214,587.84	\$257,751.35
Investment costs/bird (buildings and equipment)	\$ 9.74	\$ 8.29	\$ 7.76	\$ 7.22	\$ 7.10	\$ 6.71

Table 7. Summary of Investment Outlays for Plant Building and Equipment: Floor-Type System

Cost Item	Floor-Type System				
	One-Story Building		Two-Story Building		
			(Number of birds)		
	9,728	15,360	20,000	25,000	30,208
					32,000
Building costs	\$ 69,478.38	\$ 100,655.20	\$ 119,537.40	\$ 146,584.25	\$ 170,667.00
Equipment costs	24,992.04	32,799.14	38,479.60	45,202.63	50,545.89
					54,619.00
Material handling	17,835.88	22,860.98	28,096.32	32,400.08	36,540.66
Electrical	2,769.16	3,732.16	4,177.28	4,745.45	5,948.13
Generator	4,387.00	6,206.00	6,206.00	8,057.10	8,057.10
Total cost for buildings and equipment	\$ 94,470.42	\$ 133,454.34	\$ 158,017.00	\$ 191,786.88	\$ 221,212.89
					\$ 232,859.00
Investment costs/bird (buildings and equipment)	\$ 9.71	\$ 8.68	\$ 7.90	\$ 7.67	\$ 7.32
					\$ 7.28

work, complete carpentry, siding, insulation, and cooler-box construction.

Equipment:

Selection was based upon the recommendations of equipment salesmen and the University of Connecticut Agricultural Engineering Department; equipment used was selected for durability and low cost. Equipment costs include: (1) material handling equipment, com-

prising the cages, feeding, watering, egg collecting, waste disposing, ventilation, and cooling equipment; (2) electrical equipment comprising switches, light bulbs, wires; and (3) standby generator with sufficient starting power to operate the feeders, egg collectors, fans, and lights.

III THE DEVELOPMENT OF PRODUCTION COSTS

The first objective was to develop production costs for selected plant sizes in both floor and cage management systems. Based upon the data obtained from the survey and by consulting the appropriate farm input suppliers production costs were developed.

Fixed Overhead Costs

Annual overhead costs for fixed inputs were computed as follows: Buildings were assumed to depreciate in a straight line fashion in 15 years and equipment in 7 years. A rate of 8% of average value⁵ was used to compute annual interest charges. A rate of 10% of average value for equipment and 5% of average value for buildings was considered adequate to cover the cost of repairs. Taxes were taken as \$60.00 per \$1000 of assessed value.⁶ Insurance was assumed to cost \$1.15 of insurable value.⁷

Cash Costs

Annual operating costs for variable inputs were computed as follows: All pullets were assumed to cost \$2.40 per bird. Feed was assumed purchased from a

large supplier at a uniform price per hundredweight. The laying ration used for cage birds cost \$7.11 per cwt. The ration used for floor birds cost \$7.07 per cwt. All labor performing regular daily in-plant functions were assumed to be paid \$3.00 per hour. Labor used in annual clean-out operations was assumed to be paid \$4.00 per hour. Bird insurance is computed from bird insurable value and the insurance rate. Insurable value per bird begins at \$2.40 in the 22nd week, reaches a peak of \$2.87 by the 30th week and then declines to \$1.17 by the end of the 70th week. The insurance rate per month was taken to be \$.10/\$1000 of insurable value. Utility costs considered consist of: telephone, fuel, and electricity; electricity represents the single largest utility item. Cost of electricity was computed from actual kilowatt hours of electricity used. Electricity was priced according to Connecticut Light and Power Company residential electric service, rate #1. For supplies, the rates used are \$1.00/60 birds for cage operations and \$1.00/55 birds for floor operations. Miscellaneous items consist of one two-wheeled hand truck and 26 pallets per 15,000 birds costing \$126.00. Other supplies are applicable only to floor operations and consist of wood shavings for litter at \$1.75 per bale, and dried sugarcane for nesting material at \$5.13 per bale.

IV A COMPARISON OF PRODUCTION COSTS OF SELECTED PLANTS

The second object of the study was to compare production costs for floor and cage management system in flocks of similar sizes. Tables 8 and 9 give the minimum per unit costs of producing eggs in each of

the model plants. In the two-tier plants examined, annual costs per dozen eggs ranged from 56.23¢ to 51.40¢ in shallow-pit houses and 55.06¢ to 51.07¢ in deep-pit houses. A savings of 4.83¢ per dozen and 3.9¢ per

⁵ Average value = $\frac{\text{original value} - \text{salvage value}}{2}$. For both building and equipment, no salvage value was considered.

⁶ Assessed value is 60% of market value.

⁷ Insurable value is 80% of market value.

dozen, respectively, from the smallest operation to the largest. In the three-tier plants examined, annual costs per dozen eggs ranged from 52.80¢ to 49.52¢ in shallow-pit houses and 52.27¢ to 49.38¢ in deep-pit houses; a savings of 3.3¢ per dozen and 2.89¢ per dozen, respectively, from the smallest to the largest operation. In the floor plants examined, annual costs per dozen eggs ranged from 56.21¢ to 53.39¢; a savings of

2.82¢ per dozen from the smallest operation to the largest.

In every modeled category costs were generally lower as plants became progressively larger. The resulting fact is that the large scale egg producers are in a competitively advantageous position, based on the assumptions made and the standards used in this study.

V THE EFFECT ON PRODUCTION COSTS OF CHANGING THE PRICE OF SELECTED INPUTS

The third objective of the study was to compare the effect upon production costs of changes in the interest rate, building cost, equipment cost, labor cost,

and cost of utilities for comparably sized cage and floor models. These are presented in Tables 10 to 14.⁸ Changing building cost, labor cost, and utility cost by ten per-

Table 8. Economies of Scale in Four Cage Management Systems

Model	Capacity and cost items	Cage Row Length					
		152'	240'	312'	392'	472'	480'
Tri-deck and shallow-pit	No. of birds	18240	28800	37440	-----	56640	72000
	Cost/doz. eggs	52.80¢	51.29¢	50.64¢	-----	49.89¢	49.52¢
Tri-deck and deep-pit	No. of birds	18240	28800	37440	-----	56640	72000
	Cost/doz. eggs	52.27¢	50.98¢	50.42¢	-----	49.78¢	49.38¢
Double-deck and shallow-pit	No. of birds	9728	15360	20000	25000	30208	38400
	Cost/doz. eggs	56.23¢	53.68¢	52.81¢	52.08¢	51.91¢	51.40¢
Double-deck and deep-pit	No. of birds	9728	15360	20000	25000	30208	38400
	Cost/doz. eggs	55.06¢	52.98¢	52.25¢	51.64¢	51.54¢	51.07¢

Table 9. Economies of Scale in Automated Floor Houses

Number of birds	9728	15360	20000	25000	30208	32000
Cost per dozen eggs	56.21¢	54.95¢	54.08¢	53.79¢	53.40¢	53.39¢

⁸ In cage operations only the double-deck, deep pit houses were used.

cent affected cost per dozen eggs but did not affect comparison between systems. Cage operations were still capable of producing eggs more cheaply. For example, Table 13 shows the effect of increasing labor cost by 10%. Labor forms a relatively bigger percentage of total cost in floor operations than in cage operations. Therefore rising labor costs increase the production cost advantages of cage operations compared to floor operations. The same situation is manifest for utilities.

Interest cost changes are a little more complicated. The reason for this is two-fold: (1) interest is computed on capital cost, i.e., building and equipment;

(2) for comparably sized operations, total building costs are higher in floor operations and total equipment costs are higher in cage operations. Thus, while building cost is a more important item in floor operations, equipment cost is a more important item in cage operations. Increasing interest cost by four percentage points (Table 10) reduced the cost advantage which cage operations held over floor operations. Changes in building cost increase the cost advantage of cage operations, and changes in equipment cost give a cost advantage to floor operations. These are reflected in Tables 11 and 12.

VI APPLICATION OF THIS STUDY

It must be recognized that the best system for any farmer will depend upon many factors. These include his existing facilities, his available capital, present and probably future size of his business and his management capabilities.

This study has been confined to a comparison of specific standards under various systems. Some limits to the accuracy of study findings are: no allow-

ance was made for the farmer whose building is already depreciated; or the farmer who wishes to stretch the lifetime production of his birds by molting; or the farmer who already owns a fully equipped floor-type plant and is seriously considering a change over to a cage plant. However, because most of the basic data in this report are detailed, use of the general analytical procedure can be employed by the individual producer to make specific analyses of changes in his situation.

VII SUMMARY AND CONCLUSIONS

The purpose of this study was to determine the total unit cost of producing eggs in Connecticut under specific conditions. Costs were synthesized by determining plant and operating input technical requirements and calculating annual overhead and operating costs from the technical data. All in-plant costs directly attributable to egg production are included. Costs were made to conform to the current real situation. The twelve basic models represented floor-type and cage-type management systems at different plant sizes (from 9,728 birds to 72,000 birds).

In the lowest-cost double-deck cage system cost per dozen was 55.06¢ in the smallest 9,728 bird operation and 51.07¢ in the largest 38,400 bird operation. In the lowest-cost triple-deck cage system, cost per dozen was 52.27¢ in the smallest 18,240 bird operation and 49.38¢ in the largest 72,000 bird operation. In the floor system, cost per dozen was 56.21¢ in the smallest 9,728 bird operation and 53.39¢ in the largest 32,000 bird operation. The analysis revealed that floor

operations were more affected by changes in building cost, utilities cost and labor cost; while cage operations were affected more by changes in interest cost and equipment cost.

Because of the lower production costs associated with large scale egg-production complexes, there will be strong inducement to increase the size of the operation. The competitive pressure forced upon small producers can be expected to grow, with the result that it will become increasingly difficult for them (small producers) to remain viable.

It should be noted that those small producers who direct-market their eggs and rely to a large extent upon family labor and operate ^{partially} stable depreciated housing and equipment may continue to operate in the short run. Thus, the trends of fewer egg producers producing more eggs should continue despite the fact that input prices will continue to increase.